PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 7945

, "Front Matter: Volume 7945," Proc. SPIE 7945, Quantum Sensing and Nanophotonic Devices VIII, 794501 (24 January 2011); doi: 10.1117/12.888707

SPIE.

Event: SPIE OPTO, 2011, San Francisco, California, United States

PROCEEDINGS OF SPIE

Quantum Sensing and Nanophotonic Devices VIII

**Manijeh Razeghi
Rengarajan Sudharsanan
Gail J. Brown**
Editors

**23–27 January 2011
San Francisco, California, United States**

Sponsored and Published by
SPIE

Volume 7945

Proceedings of SPIE, 0277-786X, v. 7945

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Quantum Sensing and Nanophotonic Devices VIII*, edited by Manijeh Razeghi, Rengarajan Sudharsanan, Gail J. Brown, Proceedings of SPIE Vol. 7945 (SPIE, Bellingham, WA, 2011) Article CID Number.

ISSN 0277-786X

ISBN 9780819484826

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2011, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/11/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

xiii Conference Committee

KEYNOTE SESSION

- 7945 02 **Quantum crystals: from quantum plasticity to supersolidity (Keynote Paper)** [7945-01]
S. Balibar, A. Haziot, X. Rojas, Lab. de Physique Statistique de l'Ecole Normale Supérieure, CNRS, Univ. Paris 6 and 7 (France)

SESSION 1 QUANTUM CASCADE LASERS AND APPLICATIONS I

- 7945 03 **Mid-IR quantum cascade lasers as an enabling technology for a new generation of chemical analyzers for liquids (Invited Paper)** [7945-02]
B. Lendl, Vienna Univ. of Technology (Austria) and QuantaRed Technologies GmbH (Austria); C. Reidl-Leuthner, Vienna Univ. of Technology (Austria); W. Ritter, QuantaRed Technologies GmbH (Austria)
- 7945 05 **Narrow linewidth quantum cascade lasers as ultra-sensitive probes of molecules (Invited Paper)** [7945-04]
S. Bartalini, S. Borri, P. Cancio Pastor, I. Galli, G. Giusfredi, D. Mazzotti, P. De Natale, CNR, Istituto Nazionale di Ottica (Italy) and European Lab. for Non-linear Spectroscopy (Italy);
- 7945 06 **Quantum cascade laser sensors for online gas chromatography (Invited Paper)** [7945-05]
S. Wu, A. Deev, Y. Tang, California Institute of Technology (United States)

SESSION 2 QUANTUM CASCADE LASERS AND APPLICATIONS II

- 7945 08 **Latest progress in high power VECSELs (Invited Paper)** [7945-08]
R. G. Bedford, Air Force Research Lab. (United States); N. Terry, U.S. Air Force Academy (United States); C. Hessenius, M. Fallahi, J. Moloney, College of Optical Sciences, The Univ. of Arizona (United States)
- 7945 09 **GaSb and InP-based VCSELs at 2.3 μm emission wavelength for tuneable diode laser spectroscopy of carbon monoxide (Invited Paper)** [7945-09]
M. Ortsiefer, C. Neumeyr, J. Roskopf, VERTILAS GmbH (Germany); S. Arafin, G. Böhm, Walter Schottky Institut (Germany); A. Hangauer, J. Chen, Walter Schottky Institut (Germany) and SIEMENS AG (Germany); R. Strzoda, Siemens AG (Germany); M.-C. Amann, Walter Schottky Institut (Germany)

- 7945 0A **High finesse external cavity VCSELs: from very low noise lasers to dual frequency lasers (Invited Paper)** [7945-10]
G. Baili, Thales Research & Technology (France); M. Alouini, Thales Research & Technology (France) and Institut de Physique de Rennes, CNRS (France); L. Morvan, Thales Research & Technology (France); F. Bretenaker, Lab. Aimé Cotton, CNRS (France); I. Sagnes, Lab. de Photonique et de Nanostructures, CNRS (France); A. Garnache, Ctr. d'Electronique et de Micro-optoélectronique de Montpellier, CNRS (France); D. Dolfi, Thales Research & Technology (France)
- 7945 0B **Integrated terahertz pulse generation and amplification in quantum cascade lasers (Invited Paper)** [7945-11]
S. S. Dhillon, S. Sawallich, N. Jukam, D. Oustinov, J. Madéo, R. Rungsawang, Lab. Pierre Aigrain, CNRS, Ecole Normale Supérieure (France); S. Barbieri, P. Filloux, C. Sirtori, Univ. Paris 7-Denis Diderot (France); X. Marcadet, Alcatel-Thales III-V Lab. (France); J. Tignon, Lab. Pierre Aigrain, CNRS, Ecole Normale Supérieure (France)
- 7945 0C **High power 1D and 2D photonic crystal distributed feedback quantum cascade lasers** [7945-12]
B. Gökden, Y. Bai, S. Tsao, N. Bandyopadhyay, S. Slivken, M. Razeghi, Northwestern Univ. (United States)

SESSION 3 QUANTUM CASCADE LASERS AND APPLICATIONS III

- 7945 0D **The progress of QD laser in the near IR wavelength region (Invited Paper)** [7945-13]
D. K. Oh, Electronics and Telecommunications Research Institute (Korea, Republic of); J. S. Kim, Chonbuk National Univ. (Korea, Republic of); J. H. Lee, Korea Photonics Technology Institute (Korea, Republic of); S. U. Hong, C. W. Lee, W. S. Han, B. S. Choi, Electronics and Telecommunications Research Institute (Korea, Republic of)
- 7945 0E **DFB lasers for sensing applications in the 3.0-3.5 μm wavelength range (Invited Paper)** [7945-14]
M. O. Fischer, M. von Edlinger, L. Nähle, J. Koeth, Nanoplus GmbH (Germany); A. Bauer, M. Dallner, S. Höfling, L. Worschech, A. W. B. Forchel, Univ. Würzburg (Germany); S. Belahsene, Y. Rouillard, Institut d'Electronique du Sud, CNRS, Univ. Montpellier 2 (France)
- 7945 0G **All photonic crystal DFBs for laser arrays (Invited Paper)** [7945-16]
A. Larue, J. Campos, O. Gauthier-Lafaye, A. Monmayrant, S. Bonnefont, F. Lozes-Dupuy, CNRS-LAAS (France) and Univ. de Toulouse (France)
- 7945 0I **Modulation cancellation method for laser spectroscopy (Invited Paper)** [7945-18]
V. Spagnolo, Rice Univ. (United States) and CNR, IFN, Polytechnic Univ. of Bari (Italy); L. Dong, A. A. Kosterev, D. Thomazy, J. H. Doty III, F. K. Tittel, Rice Univ. (United States)
- 7945 0J **Acetylene measurement using quantum cascade lasers at 14 μm** [7945-19]
J. Herbst, B. Scherer, F. Singer, J. Erb, A. Lambrecht, Fraunhofer Institute for Physical Measurement Techniques (Germany); C. Rathke, S. Filip, J. Kappler, ABB Automation GmbH (Germany); P. Fuchs, J. Koeth, Nanoplus GmbH (Germany); J. Friedl, T. W. Schlereth, J. Semmel, S. Höfling, L. Worschech, A. Forchel, Univ. Würzburg (Germany)

- 7945 OK **Real time ammonia detection in exhaled human breath using a distributed feedback quantum cascade laser based sensor** [7945-20]
R. Lewicki, A. A. Kosterev, D. M. Thomazy, Rice Univ. (United States); T. H. Risby, The Johns Hopkins Univ. (United States); S. Solga, T. B. Schwartz, St. Luke's Hospital (United States); F. K. Tittel, Rice Univ. (United States)

SESSION 4 QUANTUM CASCADE LASERS AND APPLICATIONS IV

- 7945 OL **MBE growth and characterization of dilute nitrides for mid-infrared optoelectronic devices (Invited Paper)** [7945-21]
M. de la Mare, A. Krier, Q. Zhuang, P. J. Carrington, Lancaster Univ. (United Kingdom); A. Patane, The Univ. of Nottingham (United Kingdom)
- 7945 OM **Low power consumption lasers for next generation miniature optical spectrometers for trace gas analysis (Invited Paper)** [7945-22]
S. Forouhar, C. Frez, K. J. Franz, A. Ksendzov, Y. Qiu, K. A. Soibel, Jet Propulsion Lab. (United States); J. Chen, T. Hosoda, G. Kipshidze, L. Shterengas, G. Belenky, State Univ. of New York at Stony Brook (United States)
- 7945 ON **Process analytical applications in the mid-infrared (Invited Paper)** [7945-23]
S. Lundqvist, P. Kluczynski, Siemens AB (Sweden)
- 7945 OO **Faraday rotation spectroscopy of nitrogen dioxide based on a widely tunable external cavity quantum cascade laser** [7945-24]
C. A. Zaugg, ETH Zurich (Switzerland); R. Lewicki, Rice Univ. (United States); T. Day, Daylight Solutions Inc. (United States); R. F. Curl, F. K. Tittel, Rice Univ. (United States)
- 7945 OP **Stand-off explosive detection on surfaces using multispectral MIR-imaging** [7945-25]
K. Degreif, S. Rademacher, P. Dasheva, Fraunhofer Institute for Physical Measurement Techniques (Germany); F. Fuchs, S. Hugger, Fraunhofer Institute for Applied Solid State Physics (Germany); F. Schnürer, W. Schweikert, Fraunhofer Institute for Chemical Technology (Germany)
- 7945 OQ **Recent advances in resonant optothermalacoustic detection** [7945-27]
J. H. Doty III, A. A. Kosterev, F. K. Tittel, Rice Univ. (United States)
- 7945 OR **Compact portable QEPAS multi-gas sensor** [7945-28]
L. Dong, A. A. Kosterev, D. Thomazy, F. K. Tittel, Rice Univ. (United States)
- 7945 OS **Compact spectroscopic sensor for air quality monitoring in spacecrafts** [7945-29]
B. Scherer, H. Hamid, Fraunhofer Institute for Physical Measurement Techniques (Germany); J. Roskopf, VERTILAS GmbH (Germany); S. Forouhar, Jet Propulsion Lab. (United States)
- 7945 OT **Engineering intersubband population inversion with dilute nitrides** [7945-30]
M. F. Pereira, Sheffield Hallam Univ. (United Kingdom); S. Tomic, STFC Daresbury Lab. (United Kingdom)

SESSION 5 TERAHERTZ AND PLASMONICS DEVICES I

- 7945 0U **Monolithic focal plane arrays for terahertz active spectroscopic imaging: an experimental study (Invited Paper)** [7945-31]
M. Ortolani, R. Casini, F. Chiarello, S. Cibella, A. Di Gaspare, CNR, Istituto di Fotonica e Nanotecnologie (Italy); F. Evangelisti, CNR, Istituto di Fotonica e Nanotecnologie (Italy) and Univ. Roma Tre (Italy); V. Foglietti, E. Giovine, R. Leoni, G. Torrioli, CNR, Istituto di Fotonica e Nanotecnologie (Italy); A. Tredicucci, CNR, Istituto Nanoscienze (Italy); M. S. Vitiello, CNR, Istituto Nanoscienze (Italy), CNR, Istituto di Fisica Applicata N. Carrara (Italy), and CNR, Istituto di Fotonica e Nanotecnologie, Univ. di Bari (Italy); G. Scamarcio, CNR, Istituto di Fotonica e Nanotecnologie, Univ. di Bari (Italy)
- 7945 0V **Bound terahertz waves on meta-surfaces and active metamaterials (Invited Paper)** [7945-32]
J.-L. Garcia Pomar, B. Reinhard, Univ. of Kaiserslautern (Germany); J. Neu, V. Wollrab, Univ. of Kaiserslautern (Germany) and Fraunhofer Institute for Physical Measurement Techniques (Germany); O. Paul, Univ. of Kaiserslautern (Germany); R. Beigang, M. Rahm, Univ. of Kaiserslautern (Germany) and Fraunhofer Institute for Physical Measurement Techniques (Germany)
- 7945 0W **Intersubband impact ionization in THz QWIPs: shaping band structure reorganizations to design novel detectors (Invited Paper)** [7945-33]
A. Delga, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris Diderot (France); F. R. Jasnot, Lab. Pierre Aigrain, Ecole Normale Supérieure (France); A. Buffaz, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris Diderot (France); H. Guo, National Research Council Canada (Canada); L. Doyennette, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris Diderot (France); L. A. de Vaulchier, Lab. Pierre Aigrain, Ecole Normale Supérieure (France); Z. R. Wasilewski, H. C. Liu, National Research Council Canada (Canada); V. Berger, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris Diderot (France)
- 7945 0X **Phonon and polaron enhanced IR-THz photodetectors (Invited Paper)** [7945-34]
H. C. Liu, C. Y. Song, Z. R. Wasilewski, M. Buchanan, National Research Council Canada (Canada)
- 7945 0Y **GaN for THz sources (Invited Paper)** [7945-35]
M. Marso, Univ. of Luxembourg (Luxembourg)
- 7945 0Z **Terahertz emission from Mg-doped α -plane InN** [7945-36]
H. Ahn, Y.-J. Yeh, National Chiao Tung Univ. (Taiwan); S. Gwo, National Tsing Hua Univ. (Taiwan)

SESSION 6 TERAHERTZ AND PLASMONICS DEVICES II

- 7945 1I **Enhanced optical characteristics of light emitting diodes by surface plasmon of Ag nanostructures (Invited Paper)** [7945-38]
L.-W. Jang, J.-W. Ju, J.-W. Jeon, D.-W. Jeon, J.-H. Choi, Chonbuk National Univ. (Korea, Republic of); S.-J. Lee, S.-R. Jeon, J.-H. Baek, Korea Photonics Technology Institute (Korea, Republic of); E. Sari, H. V. Demir, Bilkent Univ. (Turkey); H.-D. Yoon, S.-M. Hwang, Korea Electronics Technology Institute (Korea, Republic of); I.-H. Lee, Chonbuk National Univ. (Korea, Republic of)

- 7945 12 **Infrared plasmonic detectors (Invited Paper)** [7945-39]
N. Péré-Laperne, S. Collin, F. Pardo, J.-L. Pelouard, Lab. de Photonique et de Nanostructures, CNRS (France)
- 7945 13 **Parametric study of dielectric loaded surface plasmon polariton add-drop filters for hybrid silicon/plasmonic optical circuitry (Invited Paper)** [7945-40]
A. Dereux, K. Hassan, J.-C. Weeber, N. Djellali, Lab. Interdisciplinaire Carnot, CNRS, Univ. de Bourgogne (France); S. I. Bozhevolnyi, Univ. of Southern Denmark (Denmark); O. Tsilipakos, A. Pitiakis, E. Kriezis, S. Papaioannou, K. Vysokinos, N. Pleros, Aristotle Univ. of Thessaloniki (Greece); T. Tekin, Fraunhofer Institut für Zuverlässigkeit & Mikrointegration (Germany); M. Baus, AMO Gesellschaft für Angewandte Mikro- und Optoelektronik GmbH (Germany); D. Kalavrouziotis, G. Giannoulis, H. Avramopoulos, National Technical Univ. of Athens (Greece)
- 7945 14 **Application of the theory of transients in low-background IR detectors to the research of the cold universe (Invited Paper)** [7945-41]
B. Fouks, Institute of Radio Engineering and Electronics (Russian Federation)

SESSION 7 THIN FILMS NITRIDES I

- 7945 17 **Cubic III-nitrides: potential photonic materials (Invited Paper)** [7945-44]
K. Onabe, The Univ. of Tokyo (Japan); S. Sanorpim, Chulalongkorn Univ. (Thailand); H. Kato, M. Kakuda, T. Nakamura, K. Nakamura, S. Kuboya, R. Katayama, The Univ. of Tokyo (Japan)
- 7945 18 **Optical properties of narrow-bandgap dilute nitrides (Invited Paper)** [7945-45]
S. Kuboya, M. Kuroda, Q. T. Thieu, R. Katayama, K. Onabe, The Univ. of Tokyo (Japan)
- 7945 19 **Paving the way to high-quality indium nitride: the effects of pressurized reactor (Invited Paper)** [7945-47]
T. Matsuoka, Y. Liu, Tohoku Univ. (Japan) and CREST (Japan); T. Kimura, Y. Zhang, K. Prasertsuk, Tohoku Univ. (Japan); R. Katayama, Tohoku Univ. (Japan) and CREST (Japan)
- 7945 1A **Effects of substrate quality and orientation on the characteristics of III-nitride resonant tunneling diodes** [7945-48]
Z. Vashaei, C. Bayram, R. McClintock, M. Razeghi, Northwestern Univ. (United States)

SESSION 8 THIN FILMS NITRIDES II

- 7945 1B **Control of characteristic performance by patterned structure in light-emitting diodes (Invited Paper)** [7945-49]
J. H. Baek, S.-M. Kim, Korea Photonics Technology Institute (Korea, Republic of); I.-H. Lee, Chonbuk National Univ. (Korea, Republic of); N. Hwang, Korea Photonics Technology Institute (Korea, Republic of)

- 7945 1D **III-nitride semiconductors for intersubband devices (Invited Paper)** [7945-51]
Y. Kotsar, CEA, CNRS, Nanophysique et Semiconducteurs (France); H. Machhadani, S. Sakr, CNRS, Institut d'Electronique Fondamentale, Univ. Paris-Sud 11 (France); P. K. Kandaswamy, CEA, CNRS, Nanophysique et Semiconducteurs (France); M. Tchernycheva, CNRS, Institut d'Electronique Fondamentale, Univ. Paris-Sud 11 (France); E. Bellet-Amalric, CEA, CNRS, Nanophysique et Semiconducteurs (France); F. H. Julien, CNRS, Institut d'Electronique Fondamentale, Univ. Paris-Sud 11 (France); E. Monroy, CEA, CNRS, Nanophysique et Semiconducteurs (France)
- 7945 1E **Structural characterization of III-nitride materials and devices (Invited Paper)** [7945-52]
D. J. Smith, L. Zhou, Arizona State Univ. (United States); T. D. Moustakas, Boston Univ. (United States)
- 7945 1F **GaN as a detector of α -particles and neutrons (Invited Paper)** [7945-53]
A. Y. Polyakov, N. B. Smirnov, A. V. Govorkov, Institute of Rare Metals (Russian Federation); I.-H. Lee, Chonbuk National Univ. (Korea, Republic of); S. J. Pearton, Univ. of Florida (United States); N. G. Kolin, Karpov Institute of Physical Chemistry (Russian Federation); I. L. Gazizov, International Univ. of Nature, Society and Humanity (Russian Federation); V. M. Zalyetin, Institute of Physical-Technical Problems (Russian Federation)
- 7945 1G **Advances in UV sensitive visible blind GaN-based APDs (Invited Paper)** [7945-54]
M. P. Ulmer, R. McClintock, M. Razeghi, Northwestern Univ. (United States)

SESSION 9 DETECTORS AND IMAGING I

- 7945 1H **Asymmetric InAs/GaSb superlattice pin photodiode to improve temperature operation (Invited Paper)** [7945-55]
P. Christol, C. Cervera, J. B. Rodriguez, CNRS, Institut d'Electronique du Sud, Univ. Montpellier 2 (France); K. Jaworowicz, I. Ribet-Mohamed, ONERA (France)
- 7945 1I **Room temperature photovoltaic response of split-off band infrared detectors with a graded barrier (Invited Paper)** [7945-56]
A. G. U. Perera, S. G. Matsik, D. P. Pitigala, Y. F. Lao, Georgia State Univ. (United States); S. P. Khanna, L. H. Li, E. H. Linfield, Univ. of Leeds (United Kingdom); Z. R. Wasilewski, M. Buchanan, X. H. Wu, H. C. Liu, National Research Council (Canada)
- 7945 1J **Enhancing the performance of infrared detectors for space applications (Invited Paper)** [7945-57]
D. A. Cardimona, D. H. Huang, B. Feller, M. Landau, C. Morath, Air Force Research Lab. (United States)

SESSION 10 DETECTORS AND IMAGING II

- 7945 1K **Heterogeneous GaSb/SOI mid-infrared photonic integrated circuits for spectroscopic applications (Invited Paper)** [7945-58]
N. Hattasan, Univ. Gent (Belgium); L. Cerutti, J. B. Rodriguez, E. Tournié, CNRS, Univ. Montpellier 2 (France); D. Van Thourhout, G. Roelkens, Univ. Gent (Belgium)

- 7945 1L **VLWIR high operating temperature non-equilibrium photovoltaic HgCdTe devices (Invited Paper)** [7945-59]
S. Velicu, C. H. Grein, EPIR Technologies, Inc. (United States); A. Itsuno, J. D. Phillips, Univ. of Michigan (United States)
- 7945 1N **Defect density reduction in InAs/GaSb type II superlattice focal plane array infrared detectors (Invited Paper)** [7945-61]
M. Walther, R. Rehm, J. Schmitz, J. Niemasz, F. Rutz, A. Wörl, L. Kirste, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); R. Scheibner, J. Wendler, J. Ziegler, AIM Infrarot-Module GmbH (Germany)
- 7945 1O **Growth and characterization of long wavelength infrared type II superlattice photodiodes on a 3" GaSb wafer** [7945-62]
B.-M. Nguyen, G. Chen, M.-A. Hoang, M. Razeghi, Northwestern Univ. (United States)

SESSION 11 DETECTORS AND IMAGING III

- 7945 1P **High-performance long wavelength superlattice infrared detectors (Invited Paper)** [7945-63]
A. Soibel, D. Z.-Y. Ting, C. J. Hill, M. Lee, J. Nguyen, S. A. Keo, J. M. Mumolo, S. D. Gunapala, Jet Propulsion Lab. (United States)
- 7945 1R **Lateral diffusion of minority carriers in InAsSb-based nBn detectors** [7945-65]
E. A. Plis, S. Myers, M. N. Kuty, Ctr. for High Technology Materials, Univ. of New Mexico (United States); J. Mailfert, Ctr. for High Technology Materials, Univ. of New Mexico (United States) and National Institute of Applied Sciences (France); E. P. Smith, S. Johnson, Raytheon Vision Systems (United States); S. Krishna, National Institute of Applied Sciences (France)
- 7945 1S **Gamma-ray irradiation effects on InAs/GaSb-based nBn IR detector** [7945-66]
V. M. Cowan, C. P. Morath, S. M. Swift, Air Force Research Lab. (United States); S. Myers, N. Gautam, S. Krishna, Ctr. for High Technology Materials, Univ. of New Mexico (United States)
- 7945 1T **Pixel isolation of low dark-current large-format InAs/GaSb superlattice complementary barrier infrared detector focal plane arrays with high fill factor** [7945-67]
J. Nguyen, C. J. Hill, D. Rafol, S. Keo, A. Soibel, D. Z.-Y. Ting, J. Mumolo, J. Liu, S. D. Gunapala, Jet Propulsion Lab. (United States)

SESSION 12 DETECTORS AND IMAGING IV

- 7945 1U **Vertical transport in InAs/GaSb superlattices: model results and relation to in-plane transport** [7945-68]
F. Szmulowicz, Univ. of Dayton Research Institute (United States); G. J. Brown, Air Force Research Lab. (United States)
- 7945 1V **Barrier engineered superlattice and quantum dot detectors for HOT operation (Invited Paper)** [7945-69]
J. Shao, T. E. Vandervelde, A. Barve, W. Jang, A. Stintz, S. Krishna, Ctr. for High Technology Materials, Univ. of New Mexico (United States)

- 7945 1Y **Effect of the oxide-semiconductor interface on the passivation of hybrid type-II superlattice long-wave infrared photodiodes** [7945-72]
J. A. Nolde, Naval Research Lab. (United States); R. Stine, Nova Research, Inc. (United States); E. M. Jackson, C. L. Canedy, I. Vurgaffman, Naval Research Lab. (United States); S. I. Maximenko, Global Defense Technology & Systems, Inc. (United States); C. A. Affouda, Naval Research Lab. (United States); M. Gonzalez, Global Defense Technology & Systems, Inc. (United States); E. H. Aifer, J. R. Meyer, Naval Research Lab. (United States)

SESSION 13 NANOPHOTONIC DEVICES I

- 7945 21 **Potential of carbon nanotubes films for infrared bolometers (Invited Paper)** [7945-75]
C. Koechlin, ONERA (France); S. Maine, Lab. de Photonique et de Nanostructures, CNRS (France); S. Rennesson, R. Haidar, B. Trétout, J. Jaeck, ONERA (France); N. Péré-Laperne, J.-L. Pelouard, Lab. de Photonique et de Nanostructures, CNRS (France)
- 7945 23 **Advances in nano-enabled GaN photonic devices (Invited Paper)** [7945-77]
W. N. Wang, P. A. Shields, C. Liu, D. W. E. Allsopp, F. Causa, Univ. of Bath (United Kingdom)
- 7945 24 **Patterns with PS-b-PMMA block copolymer on various substrates and their applications** [7945-78]
M. M. Alam, Y.-R. Lee, W.-G. Jung, Kookmin Univ. (Korea, Republic of)

SESSION 14 NANOPHOTONIC DEVICES II

- 7945 26 **Flexible nanogenerators for self-powered touch and light sensor applications (Invited Paper)** [7945-80]
K. Y. Lee, Sungkyunkwan Univ. (Korea, Republic of); D. Choi, Kyung Hee Univ. (Korea, Republic of); J.-Y. Choi, Samsung Advanced Institute of Technology (Korea, Republic of); S.-W. Kim, Sungkyunkwan Univ. (Korea, Republic of)
- 7945 28 **Optical nano-antennas: a new approach for optical imaging and detection (Invited Paper)** [7945-82]
J. Scheuer, I. Freidler, Y. Yifat, Z. Iluz, M. Eitan, Y. Hanein, A. Boag, Tel Aviv Univ. (Israel)

SESSION 15 NANOPHOTONIC DEVICES III

- 7945 2C **Development of chip-scale chalcogenide glass based infrared chemical sensors (Invited Paper)** [7945-86]
J. Hu, Univ. of Delaware (United States); J. D. Musgraves, N. Carlie, B. Zdyrko, I. Luzinov, Clemson Univ. (United States); A. Agarwal, Massachusetts Institute of Technology (United States); K. Richardson, Clemson Univ. (United States); L. Kimerling, Massachusetts Institute of Technology (United States)
- 7945 2D **Photonic sensors for explosive detection (Invited Paper)** [7945-87]
U. Willer, Clausthal Univ. of Technology (Germany); R. Orghici, P. Lützow, Fraunhofer Heinrich Hertz Institute (Germany); W. Schade, Clausthal Univ. of Technology (Germany) and Fraunhofer Heinrich Hertz Institute (Germany)

- 7945 2E **Differential spectral imaging with gold nanorod light scattering labels (Invited Paper)** [7945-88]
L. Qiu, E. Vitkin, L. Guo, Harvard Univ. (United States); E. B. Hanlon, Harvard Univ. (United States) and Dept. of Veterans Affairs (United States); I. Itzkan, L. T. Perelman, Harvard Univ. (United States)

SESSION 16 SINGLE PHOTON SOURCES AND DETECTORS I

- 7945 2F **Single photon emission from nitrogen delta-doped semiconductors (Invited Paper)** [7945-89]
H. Yaguchi, Saitama Univ. (Japan)
- 7945 2H **Growth and characterization of low density droplet GaAs quantum dots for single photon sources (Invited Paper)** [7945-91]
S.-K. Ha, J. D. Song, J. Y. Lim, Korea Institute of Science and Technology (Korea, Republic of); S. Bounouar, F. Donatini, L. S. Dang, J. P. Poizat, CEA, CNRS, Institut Néel (France); J. S. Kim, Yeungnam Univ. (Korea, Republic of); W. J. Choi, I. K. Han, J. I. Lee, Korea Institute of Science and Technology (Korea, Republic of)
- 7945 2I **A solid state ultrabright source of entangled photon pairs (Invited Paper)** [7945-92]
A. Dousse, J. Suffczynski, A. Beveratos, O. Krebs, A. Lemaître, I. Sagnes, J. Bloch, P. Voisin, P. Senellart, Lab. de Photonique et de Nanostructures, CNRS (France)
- 7945 2J **Semiconductor integrated sources of quantum light at room temperature (Invited Paper)** [7945-93]
A. Orioux, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris 7-Denis Diderot (France); A. Lemaître, Lab. de Photonique et Nanostructures, CNRS (France); P. Filloux, I. Favero, G. Leo, S. Ducci, Lab. Matériaux et Phénomènes Quantiques, CNRS, Univ. Paris 7-Denis Diderot (France)
- 7945 2K **Ultra-low-noise high-speed single-photon detection using a sinusoidally gated InGaAs/InP avalanche photodiode (Invited Paper)** [7945-94]
N. Namekata, S. Inoue, Institute of Quantum Science (Japan)

SESSION 17 SINGLE PHOTON SOURCES AND DETECTORS II

- 7945 2L **Compact detection module based on InGaAs/InP SPADs for near-infrared single-photon counting up to 1.7 μm (Invited Paper)** [7945-95]
A. Tosi, A. Bahgat Shehata, Politecnico di Milano (Italy); A. Della Frera, Micro Photon Devices S.r.l. (Italy); A. Dalla Mora, Politecnico di Milano (Italy); S. Tisa, Micro Photon Devices S.r.l. (Italy); F. Acerbi, Politecnico di Milano (Italy); F. Zappa, Politecnico di Milano (Italy) and Micro Photon Devices S.r.l. (Italy)
- 7945 2M **Single-photon detection in time-of-flight-depth imaging and quantum key distribution (Invited Paper)** [7945-97]
G. S. Buller, R. J. Collins, P. J. Clarke, N. J. Krichel, A. McCarthy, R. E. Warburton, F. Izdebski, R. H. Hadfield, Heriot-Watt Univ. (United Kingdom)

- 7945 2N **SPAD electronics for high-speed quantum communications (Invited Paper)** [7945-98]
J. C. Bienfang, A. Restelli, A. Migdall, National Institute of Standards and Technology (United States)
- 7945 2O **Advanced single photon counting instrumentation for SPADs** [7945-99]
A. Tosi, A. Dalla Mora, Politecnico di Milano (Italy); A. Della Frera, Micro Photon Devices S.r.l. (Italy); F. Acerbi, A. Bahgat Shehata, Politecnico di Milano (Italy); F. Zappa, Politecnico di Milano (Italy) and Micro Photon Devices S.r.l. (Italy)
- 7945 2P **Planar silicon SPADs with improved photon detection efficiency** [7945-100]
A. Gulinatti, F. Panzeri, I. Rech, Politecnico di Milano (Italy); P. Maccagnani, IMM, CNR (Italy); M. Ghioni, S. D. Cova, Politecnico di Milano (Italy) and Micro-Photon-Devices (Italy)

POSTER SESSION

- 7945 2Q **Fabrication of an all-spin-coated CdSe/ZnS quantum dot light-emitting diode** [7945-102]
A. Weiss, J. Martin, D. Piasta, T. Otto, T. Gessner, Fraunhofer Research Institution for Electronic Nanosystems (Germany)

Author Index

Conference Committee

Symposium Chair

Liang-Chy Chien, Kent State University (United States)

Symposium Cochairs

E. Fred Schubert, Rensselaer Polytechnic Institute (United States)

Klaus P. Streubel, OSRAM GmbH (Germany)

Program Track Chair

Ali Adibi, Georgia Institute of Technology (United States)

Conference Chair

Manijeh Razeghi, Northwestern University (United States)

Conference Cochairs

Rengarajan Sudharsanan, Spectrolab, Inc. (United States)

Gail J. Brown, Air Force Research Laboratory (United States)

Program Committee

Jong-Hyeob Baek, Korea Photonics Technology Institute (Korea, Republic of)

Alexei N. Baranov, Université Montpellier 2 (France)

Olivier Briot, Université Montpellier 2 (France)

David A. Cardimona, Air Force Research Laboratory (United States)

Mahmoud Fallahi, College of Optical Sciences, The University of Arizona (United States)

Jung Han, Yale University (United States)

John E. Hubbs, Ball Aerospace & Technologies Corporation (United States)

Jean-Pierre Huignard, Thales Research & Technology (France)

Mark A. Itzler, Princeton Lightwave, Inc. (United States)

Christine A. Jhabvala, NASA Goddard Space Flight Center (United States)

Woo-Gwang Jung, Kookmin University (Korea, Republic of)

Shigeyuki Kuboya, The University of Tokyo (Japan)

Armin Lambrecht, Fraunhofer-Institut für Physikalische Messtechnik (Germany)

In-Hwan Lee, Chonbuk National University (Korea, Republic of)

Ryan P. McClintock, Northwestern University (United States)
Jerry R. Meyer, U.S. Naval Research Laboratory (United States)
Mauro Fernandes Pereira, Jr., Sheffield Hallam University (United Kingdom)
Nicolas Péré-Laperne, Centre National de la Recherche Scientifique (France)
Steven Slivken, Northwestern University (United States)
Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)
Ferechteh Hosseini Teherani, Nanovation (France)
Meimei Z. Tidrow, U.S. Army Night Vision & Electronic Sensors Directorate (United States)
Miriam S. Vitiello, Consiglio Nazionale delle Ricerche (Italy)
Sheng Wu, California Institute of Technology (United States)
Franco Zappa, Politecnico di Milano (Italy)
John M. Zavada, U.S. Army Research Office (United States)

Session Chairs

Keynote Session

Manijeh Razeghi, Northwestern University (United States)

- 1 Quantum Cascade Lasers and Applications I
Armin Lambrecht, Fraunhofer-Institut für Physikalische Messtechnik (Germany)
Manijeh Razeghi, Northwestern University (United States)
- 2 Quantum Cascade Lasers and Applications II
Alexei N. Baranov, Université Montpellier 2 (France)
Shigeyuki Kuboya, The University of Tokyo (Japan)
- 3 Quantum Cascade Lasers and Applications III
Jerry R. Meyer, U.S. Naval Research Laboratory (United States)
Miriam S. Vitiello, Università degli Studi di Bari (Italy)
- 4 Quantum Cascade Lasers and Applications IV
Jean-Pierre Huignard, Thales Research & Technology (France)
Sheng Wu, California Institute of Technology (United States)
- 5 Terahertz and Plasmonics Devices I
Nicolas Péré-Laperne, Centre National de la Recherche Scientifique (France)
In-Hwan Lee, Chonbuk National University (Korea, Republic of)
- 6 Terahertz and Plasmonics Devices II
Mauro Fernandes Pereira, Jr., Sheffield Hallam University (United Kingdom)
Vincenzo Spagnolo, Politecnico di Bari (Italy)

- 7 Thin Films Nitrides I
Woo-Gwang Jung, Kookmin University (Korea, Republic of)
Manijeh Razeghi, Northwestern University (United States)
- 8 Thin Films Nitrides II
Kentaro Onabe, The University of Tokyo (Japan)
Ferechteh Hosseini Teherani, Nanovation (France)
- 9 Detectors and Imaging I
Meimei Z. Tidrow, U.S. Army Night Vision & Electronic Sensors Directorate (United States)
Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)
- 10 Detectors and Imaging II
David A. Cardimona, Air Force Research Laboratory (United States)
Jung Han, Yale University (United States)
- 11 Detectors and Imaging III
John E. Hubbs, Ball Aerospace & Technologies Corporation (United States)
Mahmoud Fallahi, College of Optical Sciences, The University of Arizona (United States)
- 12 Detectors and Imaging IV
Gail J. Brown, Air Force Research Laboratory (United States)
Christine A. Jhabvala, NASA Goddard Space Flight Center (United States)
- 13 Nanophotonic Devices I
Jong Hyeob Baek, Korea Photonics Technology Institute (Korea, Republic of)
Olivier Briot, Université Montpellier 2 (France)
- 14 Nanophotonic Devices II
Charlie Koechlin, ONERA (France)
Philip A. Shields, University of Bath (United Kingdom)
- 15 Nanophotonic Devices III
Joon Seop Kwak, Sunchon National University (Korea, Republic of)
Rashid Zia, Brown University (United States)
- 16 Single Photon Sources and Detectors I
Mark A. Itzler, Princeton Lightwave, Inc. (United States)
Melville P. Ulmer, Northwestern University (United States)

- 17 Single Photon Sources and Detectors II
 Rengarajan Sudharsanan, Spectrolab, Inc. (United States)
 Franco Zappa, Politecnico di Milano (Italy)